

WHAT IS CLAIMED IS:

1. A method for the creation of a transiently transgenic plant whereby a heterologous transgene temporarily conveys a desirable phenotypic trait to the plant, the method comprising the following steps:

a) constructing a gene cassette comprising:

- (i.) one or more DNA sequences for a gene conferring a desirable phenotypic trait;
- (ii.) one or more DNA sequences expressing a recombinase-type protein;
- (iii.) at least one pair of DNA excision sequences cleavable by the recombinase-type protein, wherein the excision sequences flank the heterologous DNA; and
- (iv.) a transiently activated promoter operably linked to the DNA sequence expressing the recombinase-type protein and controlling expression of the protein, wherein the promoter is activated, and thereby directs expression of the recombinase-type protein, in response to developmental or external stimuli;

b) introducing the cassette into the genome of the plant; and

c) exposing the DNA sequences within the cassette to a stimulus that activates the promoter, whereby the promoter directs expression of the recombinase protein, and the recombinase protein excises the heterologous DNA from the genome of the plant.

2. The method of claim 1, wherein the gene cassette further comprises a DNA sequence for a marker gene.

3. The method of claim 1, wherein the transiently-active promoter is activated only in certain organs of the plant.

4. The method of claim 1, wherein the promoter sequence is activated only at specific stages in the plant's developmental cycle.

5. The method of claim 1, wherein the promoter sequence is activated in response to an external stimulus.

6. The method of claim 5, wherein the external stimulus is selected from the group consisting of exposure to a specific chemical species, heat shock, exposure to electromagnetic radiation, and exposure to reduced temperatures.

7. A gene cassette for the reversible introduction of heterologous DNA sequences into a genome of a vegetatively propagated plant, the gene cassette comprising:

- a) a DNA sequence for one or more genes that express a recombinase-type protein;
- b) a DNA sequence for one or more transiently-active promoters operably linked to the one or more DNA sequences;
- c) one or more pairs of DNA excision sequences, wherein the excision sequences are each cleavable by the recombinase protein; and
- d) one or more heterologous DNA sequences capable of conferring a desirable phenotypic trait on the plant into which the cassette is introduced, wherein the one or more heterologous sequences are flanked by at least one of the pairs of excision sequences.

8. The gene cassette of claim 7, wherein the one or more pairs of excision sequences are recognized only by the recombinase-type protein expressed by the recombinase gene of the cassette.

9. The gene cassette of claim 7, wherein the cassette further comprises one or more selectable marker DNA sequences.

10. The gene cassette of claim 7, wherein the promoter sequence is activated only in certain organs of the plant or only at specific stages in the plant's developmental cycle.

11. The gene cassette of claim 7, wherein the promoter sequence is activated by exposure of the transformed plant to an external stimulus.

12. The gene cassette of claim 11, wherein the external stimulus is selected from the group consisting of exposure to a specific chemical species, osmotic stress, heat shock, exposure to electromagnetic radiation, and exposure to reduced temperatures.

13. The gene cassette of claim 7, wherein the gene sequence expresses a recombinase-type protein selected from the group consisting of recombinases, invertases, integrases, transposases and resolvases.

14. A gene cassette for the reversible introduction of heterologous DNA sequences into a genome of a sexually propagated plant, the gene cassette comprising:

- a) a first DNA sequence comprising:
 - (i.) a sequence that expresses a first recombinase-type protein;
 - (ii.) a sequence for an inducible promoter, operably linked to the sequence that expresses the first recombinase-type protein, wherein the promoter is capable of being activated in reaction to an external stimulus;
 - (iii.) a sequence that expresses a transcription factor capable of regulating transcriptional activity of the sequence that expresses the first recombinase-type protein; and
 - (iv.) one or more pairs of DNA excision site sequences wherein the excision sites are capable of being cleaved only by the first recombinase-type protein;
- b) a second DNA sequence comprising:
 - (i.) a sequence capable of expressing a second recombinase-type protein;

(ii.) a sequence for a transiently-active promoter capable of controlling expression of the second recombinase protein; and

(iii.) one or more heterologous DNA sequences capable of conferring a desirable phenotypic trait on the plant into the genome of which the cassette is introduced; and

c) one or more pairs of DNA excision site sequences wherein the excision sites are capable of being cleaved only by the second recombinase-type protein.

15. The gene cassette of claim 14, wherein the first DNA sequence is capable of blocking the induction of expression of the second recombinase-type protein by the transiently-active promoter.

16. The gene cassette of claim 14, wherein the second DNA sequence further comprises:

a) a sequence capable of expressing a third recombinase-type protein;

b) a sequence capable of expressing a protease protein; and

c) one or more pairs of DNA excision site sequences wherein the excision sites are capable of being cleaved only by the third recombinase-type protein,

wherein the third recombinase-type protein is linked to the expressing the second recombinase-type protein through a specific amino acid sequence capable of being cleaved by the protease protein.

17. The gene cassette of claim 14, wherein the second DNA sequence further comprises a second promoter sequence operatively linked to the sequence that expresses the protease protein.

18. The gene cassette of claim 14, wherein the second DNA sequence further comprises a marker gene sequence.

19. The gene cassette of claim 14, wherein the transiently-active promoter sequence is activated only in certain organs of the plant or only at specific stages in the plant's developmental cycle.

20. The gene cassette of claim 14, wherein the externally-inducible promoter sequence is activated in response to exposure to an external stimulus.

21. The gene cassette of claim 20, wherein the external stimulus is selected from the group consisting of exposure to a specific chemical species, heat shock, exposure to electromagnetic radiation, and exposure to reduced temperatures.

22. The gene cassette of claim 14, wherein the gene sequences expressing a recombinase-type protein express a protein selected from the group consisting of recombinases, invertases, integrases, transposases and resolvases.

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